

SECTION 3

REFERENCES

- Abdul, A.S., Kia, S.F., and Gibson, T.L., 1989, Limitations of monitoring wells for the detection and quantification of petroleum products in soils and aquifers: *Ground Water Monit. Rev.*, Spring, 1989, p. 90-99.
- Abriola, L.M., and Pinder, G.F., 1985a, A multiphase approach to the modeling of porous media contamination by organic compounds: 1. Equation development: *Water Resour. Res.*, 21:11-18.
- Abriola, L.M., and Pinder, G.F., 1985b, A multiphase approach to the modeling of porous media contamination by organic compounds: 2. Numerical Simulation: *Water Resour. Res.*, 21:19-28.
- Abriola, L.M., 1996, Organic liquid contaminant entrapment and persistence in the subsurface: Interphase mass transfer limitation and implications for remediation: 1996 Darcy Lecture, National Ground Water Association, presented at Colorado School of Mines, October 25, 1996.
- Acton, D.W., 1990, Enhanced *in situ* biodegradation of aromatic and chlorinated aliphatic hydrocarbons in anaerobic, leachate-impacted groundwaters: M.Sc. Thesis, University of Waterloo, Waterloo, Ontario.
- Adriaens, P., and Vogel, T.M., 1995, Biological treatment of chlorinated organics, *In Microbial Transformation and Degradation of Toxic Organic Chemicals:* (Young, L.Y., and Cerniglia, C.E., Eds.,) Wiley-Liss, New York, 654 p.
- AFCEE, 1995, Free Product Recovery Protocol, Rev. 2: U.S. Air Force Center for Environmental Excellence, Brooks Air Force Base, TX.
- Air Force Center for Environmental Excellence, 1994, Addendum 1 to the Test Plan and Technical Protocol for a Field Treatability Test for Bioventing.
- Alvarez-Cohen, L.M. and McCarty, P.L., 1991a, Effects of toxicity, aeration, and reductant supply on trichloroethylene transformation by a mixed methanotrophic culture: *Appl. Environ. Microbiol.*, 57(1):228-235.
- Alvarez-Cohen, L.M., and McCarty, P.L., 1991b, Product toxicity and cometabolic competitive inhibition modeling of chloroform and trichloroethylene transformation by methanotrophic resting cells: *Appl. Environ. Microbiol.*, 57(4):1031-1037.
- Alvarez, P.J.J., and Vogel, T.M., 1991, Substrate interactions of benzene, toluene, and para-xylene during microbial degradation by pure cultures and mixed culture aquifer slurries: *Appl. Environ. Microbiol.*, 57:2981-2985.
- American Petroleum Institute, 1985, Laboratory Study on Solubilities of Petroleum Hydrocarbons in Groundwater: American Petroleum Institute, Publication Number 4395.
- Anderson, M.P., 1979, Using models to simulate the movement of contaminants through groundwater flow systems: *CRC Crit. Rev. Environ. Control*, 9:97-156.
- Anderson, M.P., and Woessner, W.W., 1992, *Applied Groundwater Modeling - Simulation of Flow and Advection Transport:* Academic Press, New York, 381 p.
- Arciero, D., Vannelli, T., Logan, M., and Hooper, A.B., 1989, Degradation of trichloroethylene by the ammonia-oxidizing bacterium *Nitrosomonas europaea*: *Biochem. Biophys. Res. Commun.*, 159:640-643.

- Aronson, D. and Howard, P., 1997, Anaerobic Biodegradation of Organic Chemicals in Groundwater: A Summary of Field and Laboratory Studies (SRC TR-97-0223F), Environmental Science Center, Syracuse Research Corporation, 6225 Running Ridge Road, North Syracuse, NY 13212-2509.
- Arthur D. Little, Inc., 1985, The Installation Restoration Program Toxicology Guide. Volume1. Prepared for Air Force Systems Command, Wright-Patterson Air Force Base, OH, October 1985.
- Arthur D. Little, Inc., 1987, The Installation Restoration Program Toxicology Guide. Volume3. Prepared for Air Force Systems Command, Wright-Patterson Air Force Base, OH, June 1987.
- ASTM, 1995, Emergency Standard Guide for Risk-Based Corrective Action Applied at Petroleum Release Sites: ASTM E-1739, Philadelphia, PA.
- Atlas, R.M., 1984, *Petroleum Microbiology*: Macmillan, New York.
- Atlas, R.M., 1981, Microbial degradation of petroleum hydrocarbons - an Environmental Perspective: *Microbiol. Rev.*, 45(1):180-209.
- Atlas, R.M., 1988, *Microbiology - Fundamentals and Applications*: Macmillan, New York.
- ATSDR, 1990, Toxicological Profile for Hexachlorobenzene: Agency for Toxic Substances and Disease Registry, USPHS/USEPA, December 1990.
- Avon, L., and Bredehoeft, J.D., 1989, An analysis of trichloroethylene movement in groundwater at Castle Air Force Base, California: *J. Hydrol.*, 110:23-50.
- Baedeker, M.J., and Back, W., 1979, Hydrogeological processes and chemical reactions at a landfill: *Ground Water*, 17(5): 429-437.
- Baedeker, M.J., Siegel, D.I., Bennett, P.C., and Cozzarelli, I.M., 1988, The fate and effects of crude oil in a shallow aquifer: I. The distribution of chemical species and geochemical facies, *In U.S. Geological Survey Toxic Substances Hydrology Program, Proceedings of the Technical Meeting, Phoenix, AZ*: (Mallard, G.E. and Ragone, S.E., Eds.), September 26-30, 1988: U.S. Geological Survey Water-Resources Investigations Report 88-42320, p.13-20.
- Baehr, A.L., and Corapcioglu, M.Y., 1987, A compositional multiphase model for groundwater contamination by petroleum products: 2. Numerical simulation: *Water Resour. Res.*, 23:201-203.
- Baek, N.H., and Jaffe, P.R., 1989, The degradation of trichloroethylene in mixed methanogenic cultures: *J. Environ. Qual.*, 18:515-518.
- Bailey, G.W., and White, J.L., 1970, Factors influencing the adsorption, desorption, and movement of pesticides in soil, *In Residue Reviews*: (Gunther, F.A. and Gunther, J.D., Eds.), Springer Verlag, p. 29-92.
- Ballesteros, T.P., Fiedler, F.R., and Kinner, N.E., 1994, An investigation of the relationship between actual and apparent gasoline thickness in a uniform sand aquifer: *Ground Water*, 32(5):708-718.
- Banerjee, P., Piwoni, M.D., and Ebeid, K., 1985, Sorption of organic contaminants to a low carbon subsurface core: *Chemosphere*, 14(8):1057-1067.
- Barbee, G.C., 1994, Fate of chlorinated aliphatic hydrocarbons in the vadose zone and ground water: *Ground Water Monit. Remed.*, 14(1):129-140.
- Barker, J.F., Patrick, G.C., and Major, D., 1987, Natural attenuation of aromatic hydrocarbons in a shallow sand aquifer: *Ground Water Monit. Rev.*, Winter 1987, p. 64-71.

- Barr, K.D., 1993, Enhanced groundwater remediation by bioventing and its simulation by biomodeling: *In Proceedings of the Environmental Restoration Technology Transfer Symposium*: (R.N. Miller, Ed.), January 26-27, 1993.
- Barrio-Lage, G.A., Parsons, F.Z., Narbaitz, R.M., and Lorenzo, P.A., 1990, Enhanced anaerobic biodegradation of vinyl chloride in ground water: Environ. Toxicol. Chem., 9:403-415.
- Barrio-Lage, G.A., Parsons, F.Z., Nassar, R.S., and Lorenzo, P.A., 1987, Biotransformation of trichloroethene in a variety of subsurface materials: Environ. Toxicol. Chem. 6:571-578.
- Bartha, R., 1986, Biotechnology of petroleum pollutant biodegradation: Microb. Ecol., 12:155-172.
- Bear, J., 1972, *Dynamics of Fluids in Porous Media*: Dover Publications, New York, 764 p.
- Bear, J., 1979, *Hydraulics of Groundwater*: McGraw-Hill, New York, 569 p.
- Bedient, P.B., Rifai, H.S., and Newell, C.J., 1994, *Groundwater Contamination - Transport and Remediation*: PTR Prentice Hall, New Jersey, 541 p.
- Beller, H.R., Grbić-Galić, D., and Reinhard, M., 1992b, Microbial degradation of toluene under sulfate-reducing conditions and the influence of iron on the process: Appl. Environ. Microbiol., 58:786-793.
- Beller, H.R., Reinhard, M., and Grbić-Galić, D., 1992, Metabolic byproducts of anaerobic toluene degradation by sulfate-reducing enrichment cultures: Appl. Environ. Microbiol., 58:3192-3195.
- Benker, E., Davis, G.B., Appleyard, S., Berry, D.A., and Power, T.R., 1994, Groundwater contamination by trichloroethene (TCE) in a residential area of Perth: Distribution, mobility, and implications for management, *In Proceedings - Water Down Under '94*, 25th Congress of IAH, Adelaide, South Australia, November 1994.
- Blake, S.B., and Hall, R.A., 1984, Monitoring petroleum spills with wells - some problems and solutions: *In Proceedings of the Fourth National Symposium on Aquifer Restoration and Groundwater Monitoring*: May 23-25, 1984, p. 305-310.
- Borden, R.C. and Bedient, P.B., 1986, Transport of dissolved hydrocarbons influenced by oxygen limited biodegradation - theoretical development: Water Resour. Res., 22(13):1973-1982.
- Borden, R.C., Gomez, C.A., and Becker, M.T., 1994, Natural bioremediation of a gasoline spill. *In Hydrocarbon Bioremediation*: (Hinchee, R.E., Alleman, B.C., Hoeppel, R.E., and Miller, R.N., Eds.) p. 290-295. Lewis Publishers, Chelsea, MI.
- Borden, R.C., Gomez, C.A., and Becker, M.T., 1995, Geochemical indicators of intrinsic bioremediation: Ground Water, 33(2):180-189.
- Bosma, T.N.P., van der Meer, J.R., Schraa, G., Tros, M.E., and Zehnder, A.J.B., 1988, reductive dechlorination of all trichloro- and dichlorobenzene isomers: FEMS Microbiol. Ecol., 53:223-229.
- Bouwer, E.J., and McCarty, P.L., 1983, Transformations of 1- and 2-carbon halogenated aliphatic organic compounds under methanogenic conditions. Appl. Environ. Microbiol., 45:1286-1294.
- Bouwer, E.J., and McCarty, P.L., 1984, Modeling of trace organics biotransformation in the subsurface: Ground Water, 22(4):433-440.
- Bouwer, E.J., Rittman, B.E., and McCarty, P.L., 1981, Anaerobic degradation of halogenated 1- and 2-carbon organic compounds: Environ. Sci. Technol., 15(5):596-599.

- Bouwer, E.J. and Wright, J.P., 1988, Transformations of trace halogenated aliphatics in anoxic biofilm columns: *J. Contam. Hydrol.*, 2:155-169.
- Bouwer, E.J., 1992, Bioremediation of subsurface contaminants, *In Environmental Microbiology*: (R. Mitchell, Ed.), Wiley-Liss, New York, p. 287-318.
- Bouwer, E.J., 1994, Bioremediation of chlorinated solvents using alternate electron acceptors, *In Handbook of Bioremediation*: (Norris, R.D., Hinchee, R.E., Brown, R., McCarty, P.L., Semprini, L., Wilson, J.T., Campbell, D.H., Reinhard, M., Bouwer, E.J., Borden, R.C., Vogel, T.M., Thomas, J.M., and Ward, C.H., Eds.), Lewis Publishers, Boca Raton, FL, p.149-175.
- Bouwer, H., and Rice, R.C., 1976, A slug test for determining hydraulic conductivity of unconfined aquifers with completely or partially penetrating wells: *Water Resour. Res.*, 12(3):423-428.
- Bouwer, H., 1989, The Bouwer and Rice slug test - an update: *Ground Water*, 27(3): 304-309.
- Bradley, P.M., and Chapelle, F.H., 1996, Anaerobic mineralization of vinyl chloride in Fe(III)-reducing aquifer sediments: *Environ. Sci. Technol.*, 40:2084-2086.
- Bradley, P.M., and Chapelle, F.H., 1997, Kinetics of DCE and VC mineralization under methanogenic and Fe(III)-reducing conditions: *Environ. Sci. Technol.*, 31:2692-2696.
- Bradley, P.M., Chapelle, F.H., and Wilson, J.T., 1998, Field and laboratory evidence for intrinsic biodegradation of vinyl chloride contamination in a Fe(III)-reducing aquifer: *J. Cont. Hydrol.*, in press.
- Bredehoeft, J.D., and Konikow, L.F., 1993, Ground-water models - validate or invalidate: *Ground Water*, 31(2):178-179.
- Briggs, G.G., 1981, Theoretical and experimental relationships between soil adsorption, octanol-water partition coefficients, water solubilities, bioconcentration factors, and the parachor: *J. Agricul. Food Chem.*, 29:1050-1059.
- Broholm, K., and Feenstra, S., 1995, Laboratory measurements of the aqueous solubility of mixtures of chlorinated solvents: *Environ. Toxicol. Chem.*, 14:9-15.
- Brown, D.S. and Flagg, E.W., 1981, Empirical prediction of organic pollutant sorption in natural sediments: *J. Environ. Qual.*, 10(3):382-386.
- Bruce, L., Miller, T., and Hockman, B., 1991, Solubility versus equilibrium saturation of gasoline compounds - a method to estimate fuel/water partition coefficient using solubility or Koc, *In NWWA/API Conference on Petroleum Hydrocarbons in Ground Water*: (A. Stanley, Ed.), NWWA/API, p. 571-582.
- Brunner W., and Leisinger, T., 1978, Bacterial degradation of dichloromethane: *Experientia*, 34:1671.
- Brunner, W., Staub, D., and Leisinger, T., 1980, Bacterial degradation of dichloromethane: *Appl. Environ. Microbiol.*, 40(5):950-958.
- Brusseau, M.L., 1992, Rate-limited mass transfer and transport of organic solutes in porous media that contain immobile immiscible organic liquid: *Water Resour. Res.*, 28:33-45.
- Buscheck, T.E. and Alcantar, C.M., 1995, Regression techniques and analytical solutions to demonstrate intrinsic bioremediation, *In Proceedings of the 1995 Battelle International Conference on In-Situ and On Site Bioreclamation*, April 1995.
- Butler, B.J., and Barker, J.F., 1996, Chemical and microbiological transformation and degradation of chlorinated solvent compounds, *In Dense Chlorinated Solvents and Other DNAPLs in Groundwater: History, Behavior, and Remediation*: (Pankow, J.F., and Cherry, J.A., Eds.), Waterloo Press, Waterloo, Ontario, p. 267-312.

- Cerniglia, C. E., 1984, Microbial transformation of aromatic hydrocarbons, *In Petroleum Microbiology*: (Atlas, R.M., Ed.) Macmillan, New York., p. 99-128.
- Chapelle, F.H., Haack, S.K., Adriaens, P., Henry, M.A., and Bradley, P.M., 1996, Comparison of Eh and H₂ measurements for delineating redox processes in a contaminated aquifer: Environ. Sci. Technol., 30(12):3565-3569.
- Chapelle, F.H., McMahon, P.B., Dubrovsky, N.M., Fujii, R.F., Oaksford, E.T., and Vroblesky, D.A., 1995, Deducing the distribution of terminal electron-accepting processes in hydrologically diverse groundwater systems: Water Resour. Res., 31:359-371.
- Chapelle, F.H., Vroblesky, D.A., Woodward, J.C., and Lovley, D.R., 1997, Practical considerations for measuring hydrogen concentrations in groundwater: Environ. Sci. Technol., 31(10):2873-2877.
- Chapelle, F.H., 1993, *Ground-Water Microbiology and Geochemistry*: John Wiley & Sons, New York, 424 p.
- Chapelle, F.H., 1996, Identifying redox conditions that favor the natural attenuation of chlorinated ethenes in contaminated ground-water systems, *In Proceedings of the Symposium on Natural Attenuation of Chlorinated Organics in Ground Water, Dallas, TX, September 11-13, 1996*: EPA/540/R-96/509.
- Chiang, C.Y., Salanitro, J.P., Chai, E.Y., Colthart, J.D., and Klein, C.L., 1989, Aerobic biodegradation of benzene, toluene, and xylene in a sandy aquifer - data analysis and computer modeling: Ground Water, 27(6):823-834.
- Chiou, C.T., Porter, P.E., and Schmedding, D.W., 1983, Partition equilibria of nonionic organic compounds between soil organic matter and water: Environ. Sci. Technol., 17(4):227-231.
- Ciccioli, P., Cooper, W.T., Hammer, P.M., and Hayes, J.M., 1980, Organic solute-mineral surface interactions; a new method for the determination of groundwater velocities: Water Resour. Res., 16(1):217-223.
- Clement, T.P., 1996, Personal communication regarding proposed development of a reactive solute transport model (tentatively called RT3D). Battelle Pacific Northwest Laboratories, April 1996.
- Cline, P.V., and Delfino, J.J., 1989, Transformation kinetics of 1,1,1-trichloroethane to the stable product 1,1-dichloroethene, *In Biohazards of Drinking Water Treatment*: Lewis Publishers, Chelsea, MI, p. 47-56.
- Cline, P.V., Delfino, J.J., and Rao, P.S.C., 1991, Partitioning of aromatic constituents into water from gasoline and other complex solvent mixtures: Environ. Sci. Technol., 25:914-920.
- Cooper, W.J., Mehran, M., Riusech, D.J., and Joens, J.A., 1987, Abiotic transformation of halogenated organics: 1. Elimination reaction of 1,1,2,2-tetrachloroethane and formation of 1,1,2-trichloroethane: Environ. Sci. Technol., 21:1112-1114.
- Cox, E., Edwards, E., Lehmicke, L., and Major, D., 1995, Intrinsic biodegradation of trichloroethylene and trichloroethane in a sequential anaerobic-aerobic aquifer, *In Intrinsic Bioremediation*: (Hinchee, R.E., Wilson, J.T., and Downey, D.C., Eds.), Battelle Press, Columbus, OH, p. 223-231.
- Cozzarelli, I.M., Baedecker, M.J., Eganhouse, R.P., and Goerlitz, D.F., 1994, The geochemical evolution of low-molecular-weight organic acids derived from the degradation of petroleum contaminants in groundwater: Geochimica et Cosmochimica Acta, 58(2):863-877.

- Cozzarelli, I.M., Eganhouse, R.P., and Baedecker, M.J., 1990, Transformation of monoaromatic hydrocarbons to organic acids in anoxic groundwater environment: Environ. Geol. Water Sci., 16(2):135-142.
- Cozzarelli, I.M., Herman, J.S., and Baedecker, M.J., 1995, Fate of microbial metabolites of hydrocarbons in a coastal plain aquifer: the role of electron acceptors: Environ. Sci. Technol., 29(2):458-469.
- CRC, 1996, *CRC Handbook of Chemistry and Physics*: CRC Press.
- CRC, 1956, *Handbook of Chemistry and Physics*: CRC Press.
- Criddle, C.S., McCarty, P.L., Elliot, M.C., and Barker, J.F., 1986, Reduction of hexachloroethane to tetrachloroethylene in groundwater: J. Contam. Hydrol., 1:133-142.
- Cripps, R.E., and Watkinson, R.J., 1978, Polycyclic aromatic hydrocarbon metabolism and environmental aspects, In *Developments in Biodegradation of Hydrocarbons - 1*: (Watkinson, J. R., Ed.), Applied Science Publishers, Ltd., London, p. 133-134.
- Curtis, C.D., 1985, Clay mineral precipitation and transformation during burial diagenesis: Philosophical Transactions of the Royal Society, London, v. 315, p. 91-105.
- Dalton, H., and Stirling, D.E., Co-metabolism: Philosophical Transactions of the Royal Society, London, v. 297, p. 481-496.
- Davies, J.S. and Westlake, D.W.S., 1979, Crude oil utilization by fungi: Can. J. Microbiol., 25:146-156.
- Davis, J.W., Klier, N.J., and Carpenter, C.L., 1994a, Natural biological attenuation of benzene in groundwater beneath a manufacturing facility: Ground Water, 32(2):215-226.
- Davis, J.W., and Carpenter, C.L., 1990, Aerobic biodegradation of vinyl chloride in groundwater samples: Appl. Environ. Microbiol., 56:3878.
- Davis, R.K., Pederson, D.T., Blum, D.A., and Carr, J.D., 1993, Atrazine in a stream-aquifer system - estimation of aquifer properties from atrazine concentration profiles: Ground Water Monit. Rev., Spring, 1993, p.134-141
- Davis, A., Campbell, J., Gilbert, C., Ruby, M.V., Bennett, M., and Tobin, S., 1994b, Attenuation and biodegradation of chlorophenols in groundwater at a former wood treating facility: Ground Water, 32(2):248-257.
- Dawson K.J. and Istok, J.D., 1991, *Aquifer Testing - Design and analysis of pumping and slug tests*: Lewis Publishers, Chelsea, MI, 344 p.
- de Bont, J.A.M., Vorage, M.J.W., Hartmans, S., and van den Tweel, W.J.J., 1986, Microbial degradation of 1,3-dichlorobenzene: Appl. and Environ. Microbiol., 52:677-680.
- de Pasterovich, T.L., Baradat, Y., Barthel, R., Chiarelli, A., and Fussell, D.R., 1979, *Protection of Groundwater from Oil Pollution*: CONCAWE, The Hague, 61 p.
- De Bruin, W.P., Kotterman, M.J.J., Posthumus, M.A., Schraa, G., and Zehnder, A.J.B., 1992, Complete biological reductive transformation of tetrachloroethene to ethane: Appl. Environ. Microbiol., 58(6):1966-2000.
- Dean, J.A., 1972, *Lange's Handbook of Chemistry*, 13th ed.: McGraw-Hill, New York.
- DeStefano, T.D., Gossett, J.M., and Zinder, S.H., 1991, Reductive dehalogenation of high concentrations of tetrachloroethene to ethene by an anaerobic enrichment culture in the absence of methanogenesis: Appl. Environ. Microbiol., 57(8):2287-2292.
- Devinnny, J.S., Everett, L.G., Lu, J.C.S., and Stollar, R.L., 1990, *Subsurface Migration of Hazardous Wastes*: Van Nostrand Reinhold, 387 p.

- Dilling, W.L., Tfertiller, N.B., and Kallos, G.J., 1975, Evaporation rates and reactivities of methylene chloride, chloroform, 1,1,1-trichloroethane, trichloroethylene, tetrachloroethylene, and other chlorinated compounds in dilute aqueous solutions: Environ. Sci. Technol., 9:833-838.
- Dolfing, J., and Harrison, B.K., 1992, The Gibbs free energy of formation of halogenated aromatic compounds and their potential role as electron acceptors in anaerobic environments: Environ. Sci. Technol., 26:2213-2218.
- Domenico, P.A., and Schwartz, F.W., 1990, Physical and Chemical Hydrogeology: John Wiley and Sons, New York, 824 p.
- Domenico, P.A., 1987, An analytical model for multidimensional transport of a decaying contaminant species: J. Hydrol., 91:49-58.
- Donaghue, N.A., Griffin, M., Norris, D.G., and Trudgill, P.W., 1976, The microbial metabolism of cyclohexane and related compounds, In *Proceedings of the Third International Biodegradation Symposium*: (Sharpley, J.M. and Kaplan, A.M., Eds.), Applied Science Publishers, Ltd., London, p. 43-56.
- Downey, D.C. and Gier, M.J., 1991, Supporting the no action alternative at a hydrocarbon spill site: In *Proceedings USAF Environmental Restoration Technology Symposium*: 7-8 May, San Antonio, Texas, Section U, p.1-11.
- Dragun, J., 1988, *The Soil Chemistry of Hazardous Materials*: Hazardous Materials Control Research Institute, Silver Spring, MD, 458 p.
- Driscoll, F.G., 1986, *Groundwater and Wells, Second Edition*: Johnson Division, St. Paul, MN, 1089 p.
- Dunlap, W.J., McNabb, J.F., Scalf, M.R., and Cosby, R.L., 1977, *Sampling for Organic Chemicals and Microorganisms in the Subsurface*, EPA-600/2-77/176, U.S. Environmental Protection Agency, Ada, OK.
- Dupont, R.R., Gorder, K., Sorenson, D.L., Kembowski, M.W., and Haas, P., 1996, Case study: Eielson Air Force Base, Alaska, In *Proceedings of the Symposium on Natural Attenuation of Chlorinated Organics in Ground Water, Dallas, TX, September 11-13 1996*: EPA/540/R-96/509.
- Edwards, E.A., and Grbić-Galić, D., 1992, Complete mineralization of benzene by aquifer microorganisms under strictly anaerobic conditions: Appl. Environ. Microbiol., 58:2663-2666.
- Edwards, E.A., and Grbić-Galić, D., 1994, Anaerobic degradation of toluene and *o*-xylene by a methanogenic consortium: Appl. Environ. Microbiol., 60:313-322.
- Edwards, E.A., Wells, L.E., Reinhard, M., and Grbić-Galić, D., 1992, Anaerobic degradation of toluene and xylene by aquifer microorganisms under sulfate-reducing conditions: Appl. Environ. Microbiol., 58:794-800.
- Egli, C., Scholtz, R., Cook, A.M., and Leisinger, T., 1987, Anaerobic dechlorination of tetrachloromethane and 1,2-dichloroethane to degradable products by pure cultures of *Desulfovobacterium* sp. and *Methanobacterium* sp.: FEMS Microbiol. Lett., 43:257-261.
- Ehlke, T.A., Wilson, B.H., Wilson, J.T., and Imbrigiotta, T.E., 1994, In-situ biotransformation of trichloroethylene and cis-1,2-dichloroethylene at Picatinny Arsenal, New Jersey, In *Proceedings of the U.S. Geological Survey Toxic Substances Program, Colorado Springs, CO*: (Morganwalp, D.W. and Aranson, D.A., Eds.), Water Resources Investigation Report 94-4014.

- Ellis, D.E., Lutz, E.J., Klecka, G.M., Pardieck, D.L., Salvo, J.J., Heitkamp, M.A., Gannon, D.J., Mikula, C.C., Vogel, C.M., Sayles, G.D., Campbell, D.H., Wilson, J.T., and Maiers, D.T., 1996, Remediation Technology Development Forum Intrinsic Remediation Project at Dover Air Force Base, Delaware, *In Proceedings of the Symposium on Natural Attenuation of Chlorinated Organics in Ground Water, Dallas, TX, September 11-13, 1996:* EPA/540/R-96/509.
- Evans, P.J., Mang, D.T., and Young, L.Y., 1991a, Degradation of toluene and *m*-xylene and transformation of *o*-xylene by denitrifying enrichment cultures: *Appl. Environ. Microbiol.*, 57:450-454.
- Evans, P.J., Mang, D.T., Kim, K.S., and Young, L.Y., 1991b, Anaerobic degradation of toluene by a denitrifying bacterium: *Appl. Environ. Microbiol.*, 57: 1139-1145.
- Ewers, J.W., Clemens, W., and Knackmuss, H.J., 1991, Biodegradation of chloroethenes using isoprene as a substrate, *In Proceedings of International Symposium: Environmental Biotechnology*: European Federation of Biotechnology, Oostende, Belgium, April 1991, p. 77-83.
- Farr, A.M., Houghtalen, R.J., and McWhorter, D.B., 1990, Volume estimation of light non-aqueous phase liquids in porous media: *Ground Water*, 28(1):48-56.
- Fathepure, B.Z., and Boyd, S.A., 1988, Dependence of tetrachloroethylene dechlorination on methanogenic substrate consumption by *Methanosarcina* sp. strain DCM: *Appl. Environ. Microbiol.*, 54(12):2976-2980.
- Fathepure, B.Z., Nengu, J.P., and Boyd, S.A., 1987, Anaerobic bacteria that dechlorinate perchloroethene: *Appl. Environ. Microbiol.*, 53:2671-2674.
- Fathepure, B.Z., Tiedje, J.M., and Boyd, S.A., 1988, Reductive dechlorination of hexachlorobenzene to tri- and dichlorobenzenes in an anaerobic sewage sludge: *Appl. Environ. Microbiol.*, 54:327-330.
- Fathepure, B.Z., and Vogel, T.M., 1991, Complete biodegradation of polychlorinated hydrocarbons by a two-stage biofilm reactor: *Appl. Environ. Microbiol.*, 57:3418-3422.
- Faust, C.R., Sims, P.N., Spalding, C.P., Andersen, P.F., and Stephenson, D.E., 1990, FTWORK: A three-dimensional groundwater flow and solute transport code: Westinghouse Savannah River Company Report WSRC-RP-89-1085, Aiken, SC.
- Feeenstra, S., and Guiguer, N., 1996, Dissolution of dense non-aqueous phase liquids in the subsurface, *In Dense Chlorinated Solvents and Other DNAPLs in Groundwater*: (Pankow, J.F., and Cherry, J.A., Eds.) Waterloo Press, Portland, OR, 522 p.
- Fetter C.W., 1988, *Applied Hydrogeology*: Merrill Publishing, Columbus, OH, 592 p.
- Fetter, C.W., 1993, *Contaminant Hydrogeology*: Macmillan, New York, 458 p.
- Fogel, M.M., Taddeo, A.R., and Fogel, S., 1986, Biodegradation of chlorinated ethenes by a methane-utilizing mixed culture: *Appl. Environ. Microbiol.*, 51(4):720-724.
- Folsom, B.R., Chapman, P.J., and Pritchard, P.H., 1990, Phenol and trichloroethylene degradation by *Pseudomonas cepacia* G4: Kinetics and interactions between substrates: *Appl. Environ. Microbiol.*, 56(5):1279-1285.
- Franke, O.L., Reilly T.E., and Bennett, G.D., 1987, Definition of boundary and initial conditions in the analysis of saturated ground-water flow systems - an introduction: United States Geological Survey Techniques of Water-Resources Investigations Book 3, Chapter B5, 15 p.

- Freedman, D.L., and Gossett, J.M., 1989, Biological reductive dehalogenation of tetrachloroethylene and trichloroethylene to ethylene under methanogenic conditions: *Appl. Environ. Microbiol.*, 55(4):1009-1014.
- Freeze, R.A., and Cherry, J.A., 1979, *Groundwater*: Prentice-Hall, Englewood Cliffs, NJ, 604 p.
- Freeze, R.A., and McWhorter, D.B., 1997, A framework for assessing risk-reduction due to DNAPL mass removal from low-permeability soils: *Ground Water*, 35(1):111-123.
- Gantzer, C.J., and Wackett, L.P., 1991, Reductive dechlorination catalyzed by bacterial transition-metal coenzymes: *Environ. Sci. Technol.*, 25:715-722.
- Gelhar, L.W., Welty, L., and Rehfeldt, K.R., 1992, A critical review of data on field-scale dispersion in aquifers: *Water Resour. Res.*, 28(7):1955-1974.
- Gelhar, L.W., Montoglov, A., Welty, C., and Rehfeldt, K.R., 1985, A review of field scale physical solute transport processes in saturated and unsaturated porous media, Final Project Report, EPRI EA-4190: Electric Power Research Institute, Palo Alto, CA.
- Gerritse, J., Renard, V., Pedro-Gomes, T.M., Lawson, P.A., Collins, M.D., and Gottschal, J.C., 1996, *Desulfobacterium* sp. strain PCE1, an anaerobic bacterium that can grow by reductive dechlorination of tetrachloroethene or *ortho*-chlorinated phenols: *Arch. Microbiol.*, 165:132-140.
- Gibbs, C. R., 1976, Characterization and application of ferrozine iron reagent as a ferrous iron indicator: *Anal. Chem.*, 48:1197-1200
- Gibson, S.A., and Sewell, G.W., 1990, Stimulation of the Reductive Dechlorination of Tetrachloroethene in Aquifer Slurries by Addition of Short-Chain Fatty Acids. Abstracts of the Annual Meeting of the American Society for Microbiology, Anaheim, CA, 14-18 May, 1990.
- Gibson, D.T., and Subramanian, V., 1984, Microbial degradation of aromatic hydrocarbons, In *Microbial Degradation of Organic Compounds*: (D.T. Gibson, Ed.), Marcel-Dekker, New York, p. 181-252.
- Gibson, D.J., 1971, The microbial oxidation of aromatic hydrocarbons: *Crit. Rev. Microbiol.*, 1:199-223.
- Gillham, R.W., and O'Hannesin, S.F., 1994, Enhanced degradation of halogenated aliphatics by zero-valent iron: *Ground Water*, 32(6):958-967.
- Glantz, S.A, 1992, *Primer of Biostatistics*: McGraw-Hill, New York.
- Godsy, E.M., Goerlitz, D.F., and Grbić-Galić, D., 1992a, Methanogenic biodegradation of creosote contaminants in natural and simulated ground-water ecosystems: *Ground Water*, 30(2):232-242.
- Godsy, E.M., Goerlitz, D.F., and Grbić-Galić, D., 1992b, Methanogenic degradation kinetics of phenolic compounds in aquifer-derived microcosms: *Biodegradation*, 2:211-221.
- Goldstein, R.M., Mallory, L.M., and Alexander, M., 1985, Reasons for possible failure of inoculation to enhance biodegradation: *Appl. Environ. Microbiol.*, 50(4):977-983.
- Gorder, K.A., Dupont, R.R., Sorenson, D.L., Kemblowski, M.W., and McLean, J.E., 1996, Analysis of intrinsic bioremediation of trichloroethene-contaminated ground water at Eielson Air Force Base, Alaska, In *Proceedings of the Symposium on Natural Attenuation of Chlorinated Organics in Ground Water, Dallas, TX*: EPA/540/R-96/509, September

1996.

- Gossett, J.M., and Zinder, S.H., 1996, Microbiological aspects relevant to natural attenuation of chlorinated ethenes, *In Proceedings of the Symposium on Natural Attenuation of Chlorinated Organics in Ground Water, Dallas, TX*: EPA /540/R-96/509, September 1996.
- Grbić-Galić, D., and Vogel, T.M., 1987, Transformation of toluene and benzene by mixed methanogenic cultures: *Appl. Environ. Microbiol.*, 53:254-260.
- Grbić-Galić, D., 1990, Anaerobic microbial transformation of nonoxygenated aromatic and alicyclic compounds in soil, subsurface, and freshwater sediments: *In Soil Biochemistry*: (Bollag, J.M., and Stotzky, G., Eds.), Marcel Dekker, New York, p. 117-189.
- Guiguer, N., and Frind, E.O., 1994, Dissolution and mass transfer processes for residual organics in the saturated groundwater zone, *In Proceedings of the International Symposium on Transport and Reactive Processes in Aquifers*: International Association for Hydraulic Research, Zurich, April 11-15, 1994.
- Guiguer, N., 1993, Dissolution and mass transfer processes for residual organics in the saturated groundwater zone: Numerical modeling: Ph.D. Thesis, Dept. of Earth Sciences, University of Waterloo, Waterloo, Ontario.
- Haigler, B.E., Nishino, S.F., and Spain, J.C., 1988, Degradation of 1,2-dichlorobenzene by a *Pseudomonas sp.*: *Appl. Environ. Microbiol.*, 54:294-301.
- Hall, R.A., Blake, S.B., and Champlin, S.C. Jr., 1984, Determination of hydrocarbon thicknesses in sediments using borehole data: *In Proceedings of the Fourth National Symposium on Aquifer Restoration and Groundwater Monitoring*: May 23-25, 1984. p. 300-304.
- Harker, A.R., and Kim, Y., 1990, Trichloroethylene degradation by two independent aromatic-degrading pathways in *Alcaligenes eutrophus* JMP134: *Appl. Environ. Microbiol.*, 56(4):1179-1181.
- Harlan R.L., Kolm, K.E., and Gutentag, E.D., 1989, Water-Well Design and Construction, Developments in Geotechnical Engineering, Number 60: Elsevier, 205 p.
- Hartmans, S., de Bont, J.A.M., Tramper, J., and Luyben, K.Ch.A.M., 1985, Bacterial degradation of vinyl chloride: *Biotechnol. Lett.*, 7(6):383-388.
- Hartmans, S., and de Bont, J.A.M., 1992, Aerobic vinyl chloride metabolism in *Mycobacterium aurum* Li: *Appl. Environ. Microbiol.*, 58(4):1220-1226.
- Hassett, J.J., Banwart, W.L., and Griffin, R.A., 1983, Correlation of compound properties with sorption characteristics of nonpolar compounds by soils and sediments; concepts and limitations, *In Environment and Solid Wastes*: (Francis, C.W., and Auerbach, S.I., Eds.), Butterworths, Boston, p. 161-178.
- Hassett, J.J., Means, J.C., Banwart, W.L., and Wood, S.G., 1980, Sorption Properties of Sediments and Energy-Related Pollutants: EPA/600/3-80/041, U.S. Environmental Protection Agency, Washington, D.C.
- Haston, Z.C., Sharma, P.K., Black, J.N.P., and McCarty, P.L., 1994, Enhanced reductive dechlorination of chlorinated ethenes, *In Proceedings of the EPA Symposium on Bioremediation of Hazardous Wastes: Research, Development, and Field Evaluations*: EPA/600/R-94/075.
- Hem, J.D., 1985, Study and Interpretation of the Chemical Characteristics of Natural Water: United States Geological Survey Water Supply Paper 2254, 264 p.
- Henry, S.M., 1991, Transformation of Trichloroethylene by Methanotrophs from a Groundwater Aquifer. Ph.D. Thesis. Stanford University, Palo Alto, CA.

- Henry, S.M., and Grbić-Galić, D., 1990, Effect of mineral media on trichloroethylene oxidation by aquifer methanotrophs: *Microb. Ecol.*, 20:151-169.
- Henry, S.M., and Grbić-Galić, D., 1991a, Influence of endogenous and exogenous electron donors and trichloroethylene oxidation toxicity on trichloroethylene oxidation by methanotrophic cultures from a groundwater aquifer: *Appl. Environ. Microbiol.*, 57(1):236-244.
- Henry, S.M., and Grbić-Galić, D., 1991b, Inhibition of trichloroethylene oxidation by the transformation intermediate carbon monoxide: *Appl. Environ. Microbiol.*, 57(6):1770-1776.
- Henson, J.M., Yates, M.V., and Cochran, J.W., 1989, Metabolism of chlorinated methanes, ethanes, and ethylenes by a mixed bacterial culture growing off methane: *J. Ind. Microbiol.*, 4:29-35.
- Heron, G., Crouzet, C., Bourg, A.C.M., and Christensen, T.H., 1994, Speciation of Fe (II) and Fe(III) in contaminated aquifer sediment using chemical extraction techniques: *Environ. Sci. and Technol.*, 28:1698-1705
- Higgins, I.J., and Gilbert, P.D., 1978, The biodegradation of hydrocarbons, *In The Oil Industry and Microbial Ecosystems*: (Chator, K.W.A., and Somerville, H.J., Eds.), Heyden and Sons, London, p. 80-114.
- Hinchee, R.E., Ong, S.K., Miller, R.N., Downey, D.C., and Frandt, R., 1992, Test Plan and Technical Protocol for a Field Treatability Test for Bioventing, Rev. 2: U.S. Air Force Center for Environmental Excellence, Brooks Air Force Base, TX.
- Holliger, C., Schraa, G., Stams, A.J.M., and Zehnder, A.J.B., 1992, Enrichment and properties of an anaerobic mixed culture reductively dechlorinating 1,2,3-trichlorobenzene to 1,3-dichlorobenzene: *Appl. Environ. Microbiol.*, 58:1636-1644.
- Holliger, C., Schraa, G., Stams, A.J.M., and Zehnder, A.J.B., 1993, A highly purified enrichment culture couples the reductive dechlorination of tetrachloroethene to growth: *Appl. Environ. Microbiol.*, 59:2991-2997.
- Holliger, C., and Schumacher, W., 1994, Reductive dehalogenation as a respiratory process: *Antonie van Leeuwenhoek*, 66:239-246.
- Hopper, D.J., 1978, Incorporation of [18O] water in the formation of p-hydroxybenzyl alcohol by the p-cresol methylhydroxylase from *Pseudomonas putida*: *Biochem. J.*, 175:345-347.
- Howard, P.H., Boethling, R.S., Jarvis, W.F., Meylan, W.M., and Michalenko, E.M., 1991, *Handbook of Environmental Degradation Rates*: Lewis Publishers, Chelsea, MI.
- Howard, P.H., 1989, *Handbook of Environmental Fate and Exposure Data for Organic Chemicals, Volume I: Large Production and Priority Pollutants*: Lewis Publishers, Chelsea, MI, 574 p.
- Howard, P.H., 1990, *Handbook of Environmental Fate and Exposure Data for Organic Chemicals, Vol. II: Solvents*: Lewis Publishers, Chelsea, MI, 546 p.
- Hubbert, M.K., 1940, The theory of groundwater motion: *J. Geol.*, 48:785-944.
- Hughes, J.P., Sullivan, C.R., and Zinner, R.E., 1988, Two techniques for determining the true hydrocarbon thickness in an unconfined sandy aquifer: *In Proceedings of the Petroleum Hydrocarbons and Organic Chemicals in Ground Water: Prevention, Detection, and Restoration Conference*: NWWA/API, p. 291 -314.
- Hunt, J.R., Sitar, N., and Udell, K.S., 1988, Nonaqueous phase liquid transport and cleanup, 1. Analysis of mechanisms: *Water Resour. Res.*, 24(8):1247-1258.

- Hunt, M.J., Beckman, M.A., Borlaz, M.A., and Borden, R.C., 1995, Anaerobic BTEX Biodegradation in Laboratory Microcosms and In-Situ Columns: Proceedings of the Third International Symposium on In Situ and On-Site Bioreclamation, April 24-27, 1995, San Diego, CA.
- Huntley, D., Hawk, R.N., and Corley, H.P., 1994a, Nonaqueous phase hydrocarbon in a fine-grained sandstone - 1. Comparison between measured and predicted saturations and mobility: *Ground Water*, 32(4):626-634.
- Huntley, D., Wallace, J.W., and Hawk, R.N., 1994b, Nonaqueous phase hydrocarbon in a fine-grained sandstone - 2. Effect of local sediment variability on the estimation of hydrocarbon volumes: *Ground Water*, 32(5):778-783.
- Hutchins, S.R., Sewell, G.W., Kovacs, D.A., and Smith, G.A., 1991, Biodegradation of aromatic hydrocarbons by aquifer microorganisms under denitrifying conditions: *Environ. Sci. Technol.*, 25:68-76.
- Hutchins, S.R., 1991, Biodegradation of monoaromatic hydrocarbons by aquifer microorganisms using oxygen, nitrate, or nitrous oxide as the terminal electron acceptor: *Appl. Environ. Microbiol.*, 57:2403-2407.
- Hvorslev, M.J., 1951, Time lag and soil permeability in ground-water observations: United States Corps of Engineers Waterways Experiment Station Bulletin 36, Vicksburg, MS, 50 p.
- Jafvert, C.T., and Wolfe, N.L., 1987, Degradation of selected halogenated ethanes in anoxic sediment-water systems: *Environ. Toxicol. Chem.*, 6:827-837.
- Jamison, V.W., Raymond, R.L., and Hudson, J.O. Jr., 1975, Biodegradation of high-octane gasoline in groundwater: *Dev. Ind. Microbiol.*, v.16.
- Janssen, D.B., Scheper, A., Dijkhuizen, L., and Witholt, B., 1985, Degradation of halogenated aliphatic compounds by *Xanthobacter autotrophicus* GJ10: *Appl. Environ. Microbiol.*, 49(3):673-677.
- Javandel, I., Doughty, C., and Tsang, C., 1984, Groundwater transport: Handbook of mathematical models: American Geophysical Union Water Resources Monograph Series 10, Washington, D.C., 288 p.
- Jeffers, P.M., Ward, L.M., Woytowitch, L.M., and Wolfe, N.L., 1989, Homogeneous hydrolysis rate constants for selected chlorinated methanes, ethanes, ethenes, and propanes: *Environ. Sci. Technol.*, 23:965-969.
- Jeng, C.Y., Chen, D.H., and Yaws, C.L., 1992, Data compilation for soil sorption coefficient: *Pollut. Eng.*, 24(12):54-60.
- Johnson, R.L., Palmer, C.D., and Fish, W., 1989, Subsurface chemical processes, *In Fate and Transport of Contaminants in the Subsurface*: EPA/625/4-89/019: Environmental Protection Agency, Cincinnati, OH and Ada, OK, p. 41-56.
- Johnson, R.L., and Pankow, J.F., 1992, Dissolution of dense chlorinated solvents in groundwater, 2. Source functions for pools of solvents: *Environ. Sci. Technol.*, 26(5):896-901.
- Jones, J.G. and Eddington, M.A., 1968, An ecological survey of hydrocarbon-oxidizing microorganisms: *J. Gen. Microbiol.*, 52:381-390.
- Jury, W.A., Gardner, W.R., and Gardner, W.H., 1991, *Soil Physics*: John Wiley & Sons, New York, 328 p.
- Kaluarachchi, J.J., and Parker, J.C., 1990, Modeling multicomponent organic chemical transport in three-fluid phase porous media: *J. Contam. Hydrol.*, 5:349-374.

- Kampbell, D.H., and Vandegrift, S.A., 1998, Analysis of dissolved methane, ethane, and ethylene in ground water by a standard gas chromatographic technique: *J. Chromatogr. Sci.*, in press.
- Kampbell, D.H., Wilson, J.T., and Vandegrift, S.A., 1989, Dissolved oxygen and methane in water by a GC headspace equilibrium technique: *Int. J. Environ. Anal. Chem.*, 36:249-257.
- Karickhoff, S.W., Brown, D.S., and Scott, T.A., 1979, Sorption of hydrophobic pollutants on natural sediments: *Water Resour. Res.*, 13:241-248.
- Karickhoff, S.W., 1981, Semi-empirical estimation of sorption of hydrophobic pollutants on natural sediments and soils: *Chemosphere*, 10:833-846.
- Kaufman, W.J., and Orlob, G.T., 1956, Measuring ground water movement with radioactive and chemical tracers: *Am. Water Works Assoc. J.*, 48:559-572.
- Kembowski, M.W., and Chiang, C.Y., 1990, Hydrocarbon thickness fluctuations in monitoring wells: *Ground Water*, 28(2):244-252.
- Kenaga, E.E., and Goring, C.A.I., 1980, *ASTM Special Technical Publication 707*: American Society for Testing Materials, Washington, D.C.
- Kennedy, L.G., and Hutchins, S.R., 1992, Applied geologic, microbiologic, and engineering constraints of in-situ BTEX bioremediation: *Remediation*, p. 83-107.
- Klecka, G.M., Gonsior, S.J., and Markham, D.A., 1990, Biological transformations of 1,1,1-trichloroethane in subsurface soils and ground water: *Environ. Toxicol. Chem.*, 9:1437-1451.
- Klecka, G.M., Wilson, J.T., Lutz, E., Klier, N., West, R., Davis, J., Weaver, J., Kampbell, D. and Wilson, B., 1996, Natural attenuation of chlorinated solvents in ground water, *In Proceedings of the IBC/CELTIC Conference on Intrinsic Bioremediation*, London, UK: March 18-19, 1996.
- Klein, C., and Hurlbut Jr., S. C., 1985, *Manual of Mineralogy*: John Wiley & Sons, New York, 596 p.
- Kleopfer, R.D., Easley, D.M., Hass Jr., B.B., and Deihl, T.G., 1985, Anaerobic degradation of trichloroethylene in soil: *Environ. Sci. Technol.*, 19:277-280
- Klier, N.J., West, R.J., and Donberg, P.A, 1998, Aerobic biodegradation of dichloroethylenes in surface and subsurface soils: *Chemosphere*, in press.
- Knox, R.C., Sabatini, D.A., and Canter, L.W., 1993, *Subsurface Transport and Fate Processes*: Lewis Publishers, Boca Raton, FL, 430 p.
- Konikow, L.F., and Bredehoeft, J.D., 1978, Computer model of two-dimensional solute transport and dispersion in groundwater: United States Geological Survey, Techniques of Water Resources Investigations of the United States Geological Survey, Book 7, Chapter C2, 90 p.
- Konikow, L.F., 1978, Calibration of ground-water models, *In Verification of Mathematical and Physical Models in Hydraulic Engineering: American Society of Civil Engineers*: New York, p. 87-93.
- Krumholz, L.R., 1995, A new anaerobe that grows with tetrachloroethylene as an electron acceptor: Abstract presented at the 95th General Meeting of the American Society for Microbiology.
- Kruseman, G.P. and de Ridder, N.A., 1991, Analysis and Evaluation of Pumping Test Data: International Institute for Land Reclamation and Improvement, The Netherlands, 377 p.

- Kuhn, E.P., Colberg, P.J., Schnoor, J.L., Wanner, O., Zehnder, A.J.B., and Schwarzenbach, R.P., 1985, Microbial transformations of substituted benzenes during infiltration of river water to groundwater: laboratory column studies: Environ. Sci. Technol., 19:961-968.
- Kuhn, E.P., Zeyer, J., Eicher, P., and Schwarzenbach, R.P., 1988, Anaerobic degradation of alkylated benzenes in denitrifying laboratory aquifer columns: Appl. Environ. Microbiol., 54:490-496.
- Kukor, J.J., and Olsen, R.H., 1989, Diversity of toluene degradation following long-term exposure to BTEX in situ: *Biotechnology and Biodegradation*: Portfolio Publishing, The Woodlands, TX, p. 405-421.
- Lallemand-Barres, P., and Peaudcerf, P., 1978, Recherche des relations entre la valeur de la dispersivite macroscopique d'un milieu aquifere, ses autres caracteristiques et les conditions de mesure, etude bibliographique Bulletin, Bureau de Recherches Geologiques et Minieres. Sec. 3/4:277-287.
- Langmuir, D. and Whittemore, D.O., 1971, Variations in the stability of precipitated ferric oxyhydroxides, In *Nonequilibrium Systems in Natural Water Chemistry*, Advances in Chemistry Series 106: (J. D. Hem, Ed.), Am. Chem. Soc., Washington, D.C.
- Lanzarone, N.A., and McCarty, P.L., 1990, Column studies on methanotrophic degradation of trichloroethene and 1,2-dichloroethane: Ground Water, 28(6):910-919.
- Larson, R.A., and Weber, E.J., 1994, *Reaction Mechanisms in Environmental Organic Chemistry*: Lewis Publishers, Boca Raton, FL, 433 p.
- Leahy, J.G., and Colewell, R.R., 1990, Microbial degradation of hydrocarbons in the environment: Microbiol. Rev., 53(3):305-315.
- Lee, M.D., Mazierski, P.F., Buchanan, R.J. Jr., Ellis, D.E., and Sehayek, L.S., 1995, Intrinsic and in situ anaerobic biodegradation of chlorinated solvents at an industrial landfill, In *Intrinsic Bioremediation*: (Hinchee, R.E., Wilson, J.T., and Downey, D.C., Eds.), Battelle Press, Columbus, OH, p. 205-222.
- Lee, M.D., 1988, Biorestoration of aquifers contaminated with organic compounds: CRC Crit. Rev. Environ. Control, 18:29-89.
- Lenhard, R.J., and Parker, J.C., 1990, Estimation of free hydrocarbon volume from fluid levels in monitoring wells: Ground Water, 28(1):57-67.
- Little, C.D., Palumbo, A.V., Herbes, S.E., Lidstrom, M.E., Tyndall, R.L., and Gilmer, P.J., 1988, Trichloroethylene biodegradation by a methane-oxidizing bacterium: Appl. Environ. Microbiol., 54(4):951-956.
- Lovley, D.R., 1987, Organic matter mineralization with the reduction of ferric iron: A review. Geomicrobiology J., 5:375-399.
- Lovley, D.R., 1991, Dissimilatory Fe(III) and Mn(IV) reduction: Microbiol. Rev., June 1991, p. 259-287.
- Lovley, D.R., Baedecker, M.J., Lonergan, D.J., Cozzarelli, I.M., Phillips, E.J.P., and Siegel, D.I., 1989, Oxidation of aromatic contaminants coupled to microbial iron reduction: Nature, 339:297-299.
- Lovley, D.R., Chapelle, F.H., and Woodward, J.C., 1994, Use of dissolved H² concentrations to determine distribution of microbially catalyzed redox reactions in anoxic groundwater. Environ. Sci. Technol., 28(7):1205-1210.
- Lovley, D.R., Coates, J.D., Woodward, J.C., and Phillips, E.J.P., 1995, Benzene oxidation coupled to sulfate reduction: Appl. Environ. Microbiol., 61(3):953-958.

- Lovley, D.R., and Goodwin, S., 1988, Hydrogen concentrations as an indicator of the predominant terminal electron-accepting reaction in aquatic sediments: *Geochimica et Cosmochimica Acta*, v. 52, p. 2993-3003.
- Lovley, D.R., and Phillips, E.J.P., 1986, Availability of ferric iron for microbial reduction in bottom sediments of the freshwater tidal Potomac River: *Appl. Environ. Microbiol.*, 52:751-757.
- Lovley, D.R., and Phillips, E.J.P., 1987, Competitive mechanisms for inhibition of sulfate reduction and methane production in the zone of ferric iron reduction in sediments: *Appl. Environ. Microbiol.*, 53: 2636-2641.
- Lyman, W.J., Reidy, P.J., and Levy, B., 1992, *Mobility and Degradation of Organic Contaminants in Subsurface Environments*: C.K. Smoley, Chelsea, MI, 395 p.
- Lyman, W.J., 1982, Adsorption coefficient for soils and sediment, *In Handbook of Chemical Property Estimation Methods*: (W.J. Lyman *et al.*, Eds.), McGraw-Hill, New York, 4.1-4.33.
- Lyon, W.G., West, C.C., Osborn, M.L., and Sewell, G.W., 1995, Microbial utilization of vadose zone organic carbon for reductive dechlorination: *J. Environ. Sci. Health*, A30(7):1627-1639.
- Mabey, W., and Mill, T., 1978, Critical review of hydrolysis of organic compounds in water under environmental conditions: *J. Phys. Chem. Ref. Data*, 7:383-415.
- MacIntyre, W.G., Boggs, M., Antworth, C.P., and Stauffer, T.B., 1993, Degradation kinetics of aromatic organic solutes introduced into a heterogeneous aquifer: *Water Resour. Res.*, 29(12):4045-4051.
- Mackay, D.M., Shiu, W.Y., Maijanen, A., and Feenstra, S., 1991, Dissolution of non-aqueous phase liquids in groundwater: *J. Contam. Hydrol.*, 8:23-42.
- Mackenzie, F.T., Garrels, R.M., Bricker, O.P., and Bickley, F., 1967, Silica in sea-water: control by silica minerals: *Science*, 155:1404-1405.
- Major, D.W., Mayfield, C.I., and Barker, J.F., 1988, Biotransformation of benzene by denitrification in aquifer sand: *Ground Water*, 26:8-14.
- Malone, D.R., Kao, C.M., and Borden, R.C., 1993, Dissolution and bioremediation of nonaqueous phase hydrocarbons - model development and laboratory evaluation: *Water Resour. Res.*, 29(7):2203-2213.
- March, J., 1985, *Advanced Organic Chemistry, 3rd edition*: Wiley, New York.
- Martel, 1987, Military Jet Fuels 1944-1987: AF Wright Aeronautical Laboratories, Wright-Patterson Air Force Base, OH.
- Martin, M., and Imbrigiotta, T.E., 1994, Contamination of ground water with trichloroethylene at the Building 24 site at Picatinny Arsenal, New Jersey. *In Symposium on Natural Attenuation of Ground Water, Denver, CO, August 30-September 1, 1994*: EPA/600/R-94/162, p. 109-115.
- Mayer, K.P., Grbić-Galić, D., Semprini, L., and McCarty, P.L., 1988, Degradation of trichloroethylene by methanotrophic bacteria in a laboratory column of saturated aquifer material: *Water Sci. Technol. (Great Britain)*, 20(11/12):75-178.
- Maymo-Gatell, X., Tandoi, V., Gossett, J.M., and Zinder, S.H., 1995, Characterization of an H₂-utilizing enrichment culture that reductively dechlorinates tetrachlorethene to vinyl chloride in the absence of methanogenesis acetogenesis: *Appl. Environ. Microbiol.*, 61: 3928-3933.

- McCall, P.J., Swann, R.L., and Laskowski, 1983, Partition models for equilibrium distribution of chemicals in environmental compartments, *In Fate of Chemicals in the Environment: American Chemical Society*: (Swann, R.L., and Eschenroder, A., Eds.), p. 105-123.
- McCarthy, K.A., and Johnson, R.L., 1992, Transport of volatile organic compounds across the capillary fringe: *Water Resour. Res.*, 29(6):1675-1683.
- McCarty, P.L., Reinhard, M., and Rittmann, B.E., 1981, Trace organics in groundwater: *Environ. Sci. Technol.*, 15(1):40-51
- McCarty, P.L., Roberts, P.V., Reinhard, M., and Hopkins, G., 1992, Movement and transformations of halogenated aliphatic compounds in natural systems, *In Fate of Pesticides and Chemicals in the Environment*: (Schnoor, J.L., Ed.), John Wiley & Sons, New York, p. 191-209.
- McCarty, P.L., and Semprini, L., 1994, Ground-water treatment for chlorinated solvents, *In Handbook of Bioremediation*: (Norris, R.D., Hinchee, R.E., Brown, R., McCarty, P.L., Semprini, L., Wilson, J.T., Kampbell, D.H., Reinhard, M., Bouwer, E.J., Borden, R.C., Vogel, T.M., Thomas, J.M., and Ward, C.H., Eds.), Lewis Publishers, Boca Raton, FL p. 87-116.
- McCarty, P.L., 1972, Energetics of organic matter degradation, *In Water Pollution Microbiology*: (R. Mitchell, Ed.), Wiley-Interscience, p. 91-118.
- McCarty, P.L., 1994, An Overview of Anaerobic Transformation of Chlorinated Solvents: *In Symposium on Intrinsic Bioremediation in Ground Water, Denver, CO, August 30 - September 1, 1994*, p.135-142.
- McDonald, G., and Harbaugh, A.W., 1988, A modular three-dimensional finite-difference groundwater flow model: U.S. Geological Survey Techniques of Water Resources Investigations, book 6, chapter A1.
- Mckenna, E. J., and Kallio, R.E., 1964, Hydrocarbon structure - its effect on bacterial utilization of alkanes, *In Principles and Applications in Aquatic Microbiology*: (Heukelian, H. and Dondero, W.C., Eds.), John Wiley & Sons, New York, p. 1-14.
- Means, J.C., Wood, S.G., Hassett, J.J., and Banwart, W.L., 1980, Sorption of polynuclear aromatic hydrocarbons by sediments and soils: *Environ. Sci. Technol.*, 14(12): 524-1528.
- Mercer, J.W., and Cohen, R.M., 1990, A review of immiscible fluids in the subsurface - properties, models, characterization and remediation: *J. Contam. Hydrol.*, 6:107-163.
- Mercer, J.W., and Faust, C.R., 1981, *Ground-water Modeling*: National Water Well Association, 60 p.
- Miller, C.T., Poirer-McNeill, M.M., and Mayer, A.S., 1990, Dissolution of trapped nonaqueous phase liquids: Mass transfer characteristics: *Water Resour. Res.*, 26:2783-2796.
- Miller, R.E., and Guengerich, F.P., 1982, Oxidation of trichloroethylene by liver microsomal cytochrome P-450: Evidence for chlorine migration in a transition state not involving trichloroethylene oxide: *Biochemistry*, 21:1090-1097.
- Miller, R.N., 1990, A field-scale investigation of enhanced petroleum hydrocarbon biodegradation in the vadose zone at Tyndall Air Force Base, Florida, *In Proceedings of the Petroleum Hydrocarbons and Organic Chemicals in Ground Water: Prevention, Detection, and Restoration Conference*: NWWA/API, p. 339 -351.
- Molz., F.J., Boman, G.K., Young, S.C., and Waldrop, W.R., 1994, Borehole flowmeters: Field application and data analysis: *J. Hydrol.*, 163:347-371.
- Molz., F.J. and Young, S.C., 1993, Development and application of borehole flowmeters for environmental assessment: *The Log Analyst*, v. 3, p. 13 - 23.

- Monod, J., 1942, *Recherches sur la Croissance des Cultures Bacteriennes*: Herman & Cie, Paris.
- Morel, F.M.M. and Hering, J.G., 1993, *Principles and Applications of Aquatic Chemistry*: John Wiley & Sons, New York.
- Murray, W.D. and Richardson, M., 1993, Progress toward the biological treatment of C₁ and C₂ halogenated hydrocarbons: *Crit. Rev. Environ. Sci. Technol.*, 23(3):195-217.
- National Research Council, 1993, *In Situ Bioremediation, When Does it Work?*: National Academy Press, Washington, D.C., 207 p.
- Naumov, G.B., Ryzhenko, B.N. and Khodakovsky, I.L., 1974, *Handbook of Thermodynamic Data*: (translated fm. the Russian): U.S. Geol. Survey, USGS-WRD-74-001.
- Neely, W.B., 1985, Hydrolysis, *In Environmental Exposure from Chemicals, Vol. 1*: (Neely, W.B. and Blau, G.E., Eds.), CRC Press, Boca Raton, FL, p. 157-173.
- Nelson, M.J.K., Montgomery, S.O., Mahaffey, W.R., and Pritchard, P.H., 1987, Biodegradation of trichloroethylene and involvement of an aromatic biodegradative pathway: *Appl. Environ. Microbiol.*, 53(5):949-954.
- Nelson, M.J.K., Montgomery, S.O., O'Neill, E.J., and Pritchard, P.H., 1986, Aerobic metabolism of trichloroethylene by a bacterial isolate: *Appl. Environ. Microbiol.*, 52(2):383-384.
- Nelson, M.J.K., Montgomery, S.O., and Pritchard, P.H., 1988, Trichloroethylene metabolism by microorganisms that degrade aromatic compounds: *Appl. Environ. Microbiol.*, 54(2):604-606.
- Neumann, A., Scholz-Muramatsu, H., and Diekert, G., 1994, Tetrachloroethene metabolism of *Dehalorespirillum multivorans*: *Arch. Microbiol.*, 162:295-301.
- Newell, C.J., McLeod, R.K., and Gonzales, J.R., 1996, *Bioscreen: Natural Attenuation Decision Support System User's Manual, Version 1.3*, EPA/600/R-96/087.
- Newman, W.A., and Kimball, G., 1991, Dissolved oxygen mapping; A powerful tool for site assessments and groundwater monitoring: *In Proceedings of the Fifth National Outdoor Action Conference on Aquifer Restoration, Groundwater Monitoring, and Geophysical Methods*, Number 5, p. 103-117.
- Nishino, S.F., Spain, J.C., and Pettigrew, C.A., 1994, Biodegradation of chlorobenzene by indigenous bacteria: *Environ. Toxicol. Chem.*, 13:871-877.
- Norris, R.D., Hinchee, R.E., Brown, R., McCarty, P.L., Semprini, L., Wilson, J.T., Campbell, D.H., Reinhard, M., Bouwer, E.J., Borden, R.C., Vogel, T.M., Thomas, J.M., and Ward, C.H., 1994, *Handbook of Bioremediation*: Lewis Publishers, Boca Raton, FL, 257 p.
- Oldenhuis, R., Oedzes, J.Y., van der Waarde, J.J., and Janssen, D.B., 1991, Kinetics of chlorinated hydrocarbon degradation by *Methylosinus trichosporum* OB3b and toxicity of trichloroethylene: *Appl. Environ. Microbiol.*, 57(7):7-14.
- Oldenhuis, R., Vink, R.L.J.M., Janssen, D.B., and Witholt, B., 1989, Degradation of chlorinated aliphatic hydrocarbons by *Methylosinus trichosporum* OB3b expressing soluble methane monooxygenase: *Appl. Environ. Microbiol.*, 55(11):2819-2826.
- Olsen, R.L., and Davis, A., 1990, Predicting the fate and transport of organic compounds in groundwater (Part I): *Hazardous Materials Control*, 3(3):39-64.
- Pankow, J.F., 1986, Magnitude of artifacts caused by bubbles and headspace in the determination of volatile compounds in water: *Anal. Chem.*, 58:1822-1826.
- Parker, J.C., and van Genuchten, 1984, Determining transport parameters from laboratory and field tracer experiments: *Virginia Agricultural Experiment Station, Bulletin*, 84-3.

- Parsons, F., Barrio-Lage, G., and Rice, R., 1985, Biotransformation of chlorinated organic solvents in static microcosms: *Environ. Toxicol. Chem.*, 4:739-742.
- Parsons, F., Wood., P.R., and DeMarco, J., 1984, Transformations of tetrachloroethene and trichloroethene in microcosms and groundwater: *J. Am. Water Works Assoc.*, 76:56-59.
- Payne, W.J., 1981, The status of nitric oxide and nitrous oxide as intermediates in denitrification: *In Denitrification, Nitrification, and Atmospheric Nitrous Oxide*: (Delwiche, C.C., Ed.), Wiley-Interscience, New York, p. 85-103.
- Perry, J.J. 1984, Microbial metabolism of cyclic alkanes, *In Petroleum Microbiology*: (Atlas, R.M., Ed.), Macmillan, New York, p. 61-67.
- Pickens, J.F., and Grisak, G.E., 1981, Scale-dependent dispersion in a stratified granular aquifer: *Water Resour. Res.*, 17(4):1191-1211.
- Postgate, J.R. 1984. *The Sulfate-reducing Bacteria*: Cambridge University Press, New York.
- Powers, S.E., Abriola, L.M., and Weber, W.J., Jr., 1992, Development of phenomenological models for NAPL dissolution processes, *In Proceedings of the Subsurface Restoration Conference: Dallas, Texas, June 21-24, 1992*: Rice U., Houston, p. 250-252.
- Prickett, T.A., and Lonnquist, G., 1971, Selected digital computer techniques for groundwater resource evaluation: Illinois State Water Survey Bulletin 55, 62 p.
- Prickett, T.A., Naymik, T.G., and Lonnquist, C.G., 1981, A "random walk" solute transport model for selected groundwater quality evaluations: Illinois State Water Survey Bulletin 65, 103 p.
- Puls, R.W., and Barcelona, M.J., 1996, *Low-flow (minimal drawdown) Ground-water Sampling Procedures*: EPA/540/S-95/504.
- Ramanand, K., Balba, M.T., and Duffy, J., 1993, Reductive dehalogenation of chlorinated benzenes and toluenes under methanogenic conditions: *Appl. Environ. Microbiol.*, 59:3266-3272.
- Rao, P.S.C., and Davidson, J.M., 1980, Estimation of pesticide retention and transformation parameters required in nonpoint source pollution models, *In Environmental Impact of Nonpoint Source Pollution*: (Overcash, M.R., and Davidson, J.M., Eds.), Ann Arbor Science Publishers, Ann Arbor, MI, p. 23-67.
- Reeves, M., and Cranwell, R.M., 1981, User's manual for the Sandia waste-isolation flow and transport model: Report SAND81-2516 and NUREG/CR-2324, Sandia National Laboratories, Albuquerque, NM.
- Reineke, W., and Knackmuss, H.J., 1984, Microbial metabolism of haloaromatics: Isolation and properties of a chlorobenzene-degrading bacterium: *European J. Appl. Microbiol. Biotechnol.*, 47:395-402.
- Reinhard, M., Curtis, G.P., and Kriegman, M.R., 1990, *Abiotic Reductive Dechlorination of Carbon Tetrachloride and Hexachloroethane by Environmental Reductants*: Project Summary, EPA/600/S2-90/040, September 1990.
- Reinhard, M., Goodman, N.L., and Barker, J.F., 1984, Occurrence and distribution of organic chemicals in two landfill leachate plumes: *Environ. Sci. Technol.*, 18:953-961.
- Rice, D.W., Grose, R.D., Michaelsen, J.C., Dooher, B.P., MacQueen, D.H., Cullen, S.J., Kastenberg, W.E., Everett, L.G., and Marino, M.A., 1995, California Leaking Underground Fuel Tank (LUFT) Historical Case Analyses: California State Water Resources Control Board.

- Rifai, H.S., Bedient, P.B., Borden, R.C., and Haasbeek, J.F., 1989, *Bioplume II - Computer Model of Two-dimensional Transport Under the Influence of Oxygen-limited Biodegradation in Groundwater (User's Manual Version 1.0, Preprocessor Service Code Version 1.0, Source Code Version 1.0)*: EPA/600/8-88/093, NTIS PB 89-151120.
- Rifai, H.S., Bedient, P.B., Wilson, J.T., Miller, K.M., and Armstrong, J.M., 1988, Biodegradation modeling at aviation fuel spill site: *J. Environ. Eng.*, 114(5):1007-1029.
- Riser-Roberts, E., 1992, *Bioremediation of Petroleum Contaminated Sites*: CRC Press, Boca Raton, FL, 461 p.
- Rittman, B.E. and McCarty, P.L., 1980, Utilization of dichloromethane by suspended and fixed-film bacteria: *Appl. Environ. Microbiol.*, 39(6):1225-1226.
- Rivett, M.O., 1995, Soil-gas signatures from volatile chlorinated solvents: Borden Field Experiments: *Ground Water*, 33(1):84-98.
- Roberts, P.V., Reinhard, M., and Valocchi, A.J., 1982, Movement of organic contaminants in groundwater: *J. Am. Water Works Assoc.*, 74(8):408-413.
- Roberts, P.V., Schreiner, J., and Hopkins, G.D., 1982, Field study of organic water quality changes during groundwater recharge in the Palo Alto Baylands: *Water Res.*, 16:1025-1035.
- Roy, W.R., Krapac, I.G., Chou, S.F.J., and Griffin, R.A., 1992, Batch-type procedures for estimating soil adsorption of chemicals: United States Environmental Protection Agency Technical Resource Document EPA/530-SW-87-006-F, 100 p.
- Sander, P., Wittaich, R.M., Fortnagel, P., Wilkes, H., and Francke, W., 1991, Degradation of 1,2,4-trichloro- and 1,2,4,5-tetrachlorobenzene by *Pseudomonas* strains: *Appl. Environ. Microbiol.*, 57:1430-1440.
- Saunders, F.Y., and Maltby, V., 1996, Degradation of chloroform under anaerobic soil conditions, In *Proceedings of the Symposium on Natural Attenuation of Chlorinated Organics in Ground Water, Dallas, TX, September 11-16, 1996*: EPA/540/R-96/509.
- Schaumburg, F.D., 1990, Banning trichloroethylene: Responsible reaction or overkill?: *Environ. Sci. Technol.*, 24:17-22.
- Scholz-Muramatsu, H., Szewzyk, R., Szewzyk, U. and Gaiser, S., 1990, Tetrachloroethylene as electron acceptor for the anaerobic degradation of benzoate: *FEMS Microbiol. Lett.*, 66:81-86.
- Schraa, G., Boone, M.L., Jetten, M.S.M., van Neerven, A.R.W., Colberg, P.J., and Zehnder, A.J.B., 1986, Degradation of 1,2-dichlorobenzene by *Alcaligenes sp.* strain A175: *Appl. Environ. Microbiol.*, 52:1374-1381.
- Schwarzenbach, R.P., Giger, W., Hoehn, E., and Schneider, J.K., 1983, Behavior of organic compounds during infiltration of river water to groundwater. Field studies: *Environ. Sci. Technol.*, 17(9):472-479.
- Schwarzenbach, R.P., and Westall, J., 1981, Transport of nonpolar organic compounds from surface water to groundwater. Laboratory sorption studies: *Environ. Sci. Technol.*, 15(11):1360-1367.
- Schwarzenbach, R.P., and Westall, J., 1985, Sorption of hydrophobic trace organic compounds in groundwater systems: *Water Sci. Technol.*, 17(8):39-55.
- Sellers, K.L., and Schreiber, R.P., 1992, Air sparging model for predicting groundwater clean up rate: In *Proceedings of the 1992 NGWA Petroleum Hydrocarbons and Organic Chemicals in Ground Water, Prevention, Detection, and Restoration Conference*, November, 1992.

- Sewell, G.W., and Gibson, S.A., 1990, Reductive Dechlorination of Tetrachloroethene and Trichloroethene Linked to Anaerobic Degradation of Toluene in Fuel and Solvent Contaminated Aquifer Material. Abstracts of the Annual Meeting of the American Society for Microbiology, Anaheim, CA, 14-18 May, 1990.
- Sewell, G.W., Wilson, B.H., Wilson, J.T., Campbell, D.H. and Gibson, S.A., 1991, Reductive dechlorination of tetrachloroethene and trichloroethene in fuel spill plumes. In *Chemical and Biochemical Detoxification of Hazardous Waste II*: (Glaser, J.A., Ed.), Lewis Publishers, Chelsea, MI, in press.
- Sewell, G.W., and Gibson, S.A., 1991, Stimulation of the reductive dechlorination of tetrachloroethene in anaerobic aquifer microcosms by the addition of toluene: Environ. Sci. Technol., 25(5):982-984.
- Sharma, P.K., and McCarty, P.L., 1996, Isolation and characterization of a facultatively aerobic bacterium that reductively dehalogenates tetrachloroethene to cis-1,2-dichloroethene: Appl. Environ. Microbiol., 62:761-765.
- Shiu, W.Y., Maijanen, A., Ng, L.Y., and Mackay, D., 1988, Preparation of aqueous solutions of sparingly soluble organic substances: II. Multicomponent systems - Hydrocarbon mixtures and petroleum products: Environ. Toxicol. Chem., 7:125-137.
- Singer, M.E., and Finnerty, W.R., 1984, Microbial metabolism of straight-chain and branched alkanes, In *Petroleum Microbiology*: (Atlas, R.M., Ed.), Macmillan, New York, p. 1-59.
- Smatlak, C.R., Gossett, J.M., and Zinder, S.H., 1996, Comparative kinetics of hydrogen utilization for reductive dechlorination of tetrachloroethene and methanogenesis in an anaerobic enrichment culture: Environ. Sci. Technol., 30:2850-2858.
- Smith, J.H., Harper, J.C., and Jaber, H., 1981, Analysis and environmental fate of Air Force distillate and high density fuels: Report No. ESL-TR-81-54, Tyndall Air Force Base, FL, Engineering and Services Laboratory.
- Smith, M.R, 1990, The biodegradation of aromatic hydrocarbons by bacteria: Biodegradation, 1:191-206.
- Snoeyink, V.L. and Jenkins, D., 1980, *Water Chemistry*: John Wiley & Sons, New York.
- Spain, J.C., and Nishino, S.F., 1987, Degradation of 1,4-dichlorobenzene by a *Pseudomonas* sp.: Appl. Environ. Microbiol., 53:1010-1019.
- Spain, J.C., 1996, Future vision: Compounds with potential for natural attenuation, In *Proceedings of the Symposium on Natural Attenuation of Chlorinated Organics in Ground Water, Dallas TX, September 11-13, 1996*: EPA /540/R-96/509.
- Spitz, K., and Moreno, J., 1996, *A Practical Guide to Groundwater and Solute Transport Modeling*: John Wiley & Sons, New York, 461 p.
- Srinivasan, P., and Mercer, J.W., 1988, Simulation of biodegradation and sorption processes in groundwater: Ground Water, 26(4):475-487.
- Starr, R.C. and Gillham, R.W., 1993, Denitrification and organic carbon availability in two aquifers: Ground Water, 31(6):934-947.
- Stauffer, T.B., Antworth, T.B., Boggs, J.M., and MacIntyre, W.G., 1994, A Natural Gradient Tracer Experiment in a Heterogeneous Aquifer with Measured In Situ Biodegradation Rates: A Case for Natural Attenuation: *Symposium on Natural Attenuation of Ground Water*: EPA/600/R-94/162, September 1994. p. 68-74.
- Stookey, L.L., 1970, Ferrozine-A new spectrophotometric reagent for iron: Analy. Chem., 42:779-781.

- Stotzky, G., 1974, Activity, ecology, and population dynamics of microorganisms in soil, *In Microbial Ecology*: (Laskin,A., and Lechevalier, H., Eds.), CRC Press, Cleveland, p. 57-135.
- Strack, O.D.L., 1989, *Groundwater Mechanics*: Prentice-Hall, Englewood Cliffs, NJ, 732 p.
- Stucki, J.W., Komadel, P., and Wilkinson, H.T., 1987, Microbial reduction of structural iron (III) in smectites: *Soil Sci. Soc. Am. J.*, 51:1663-1665.
- Stucki, G., Krebsler, U., and Leisinger, T., 1983, Bacterial growth on 1,2-dichloroethane: *Experientia*, 39:1271-1273.
- Stucki, J.W., Low, P.F., Roth, C.B., and Golden, D.C., 1984, Effects of oxidation state of octahedral iron on clay swelling: *Clays and Clay Minerals*, 32:357-362.
- Stumm, W., and Morgan, J.J., 1981, *Aquatic Chemistry*: John Wiley & Sons, New York.
- Suflita, J.M., Gibson, S.A., and Beeman, R.E., 1988, Anaerobic biotransformations of pollutant chemicals in aquifers: *J. Ind. Microbiol.*, 3:179-194.
- Suflita, J.M., and Townsend, G.T., 1995, The microbial ecology and physiology of aryl dehalogenation reactions and implications for bioremediation, *In Microbial Transformation and Degradation of Toxic Organic Chemicals*: (Young, L.Y., and Cerniglia, C.E., Eds.), Wiley-Liss, New York, 654 p.
- Sun, Y., Petersen, J.N., Clement, T.P., and Hooker, B.S., 1996, A modular computer model for simulating natural attenuation of chlorinated organics in saturated ground-water aquifers, *In Proceedings of the Symposium on Natural Attenuation of Chlorinated Organics in Ground Water, Dallas, TX, September 11-13, 1996*: EPA/540/R-96/509.
- Sutton, C., and Calder, J.A., 1975, Solubility of higher-molecular weight n-paraffins in distilled water and seawater: *J. Chem. Eng. Data*, 20:320-322.
- Swanson, M., Wiedemeier, T.H., Moutoux, D.E., Kampbell, D.H., and Hansen, J.E., 1996, Patterns of natural attenuation of chlorinated aliphatic hydrocarbons at Cape Canaveral Air Station, Florida, *In Proceedings of the Symposium on Natural Attenuation of Chlorinated Organics in Ground Water, Dallas, TX, September 11-13, 1996*: EPA/540/R-96/509.
- Windoll, M.C., Aelion, C.M., and Pfender, F.K., 1988, Influence of inorganic and organic nutrients on aerobic biodegradation and on the adaptation response of subsurface microbial communities: *Appl. Environ. Microbiol.*, 54(1):221-217.
- Tabak, H.H., Quave, S.A., Mashni, C.I., and Barth, E.F., 1981, Biodegradability studies with organic priority pollutant compounds: *J. Water Pollut. Contr. Fed.*, 53:1503-1518.
- Testa, S.M., and Paczkowski, M.T., 1989, Volume determination and recoverability of free hydrocarbon: *Ground Water Monit. Rev.*, Winter 1989, p. 120-128.
- Thierrin, J., Davis, G.B., Barber, C., Patterson, B.M., Pribac, F., Power, T.R., and Lambert, M., 1992, Natural degradation rates of BTEX compounds and naphthalene in a sulfate reducing groundwater environment, *In In-Situ Bioremediation Symposium "92", Niagara-on-the-Lake, Ontario, Canada, September 20-24, 1992*: in press.
- Tiedje, J.M. and Stevens, T.O., 1988, The Ecology of an Anaerobic Dechlorination Consortium. *In Environmental Biotechnology: Reducing Risks from Environmental Chemicals Through Biotechnology*: (Omen, G.S., Ed.), Plenum Press, New York. p. 3-14.
- Trudgill, P.W., 1984, Microbial degradation of the alicyclic ring: structural relationships and metabolic pathways, *In Microbial Degradation of Organic Compounds*: (Gibson, D.T., Ed.), Marcel Dekker, New York, p. 131-180.

- Tsien, H.C., Brusseau, G.A., Hanson, R.S., and Wackett, L.P., 1989, Biodegradation of trichloroethylene by *Methylosinus trichosporum*: *Appl. Environ. Microbiol.*, 55(12):3155-3161.
- U.S. Council on Environmental Quality, 1981, *Contamination of Groundwater by Toxic Organic Chemicals*: U.S. Government Printing Office, Washington, D.C.
- U.S. Environmental Protection Agency, 1986, Background Document for the Ground-Water Screening Procedure to Support 40 CFR Part 269 - Land Disposal: EPA/530-SW-86-047, January 1986.
- U.S. Environmental Protection Agency, 1987, A Compendium of Superfund Field Methods. EPA/540/P-87/001A. OSWER Directive 9355.0-14.
- U.S. Environmental Protection Agency, 1990, Groundwater - Volume 1: Groundwater and Contamination: EPA/625/6-90/016A.
- U.S. Environmental Protection Agency, 1991a, *Handbook of Suggested Practices for the Design and Installation of Ground-Water Monitoring Wells*: EPA/600/4-89/034, 221 pp.
- U.S. Environmental Protection Agency, 1992b, Contract Laboratory Program Statement of Work for Inorganics Analyses, Multi-Media, Multi-Concentration. Document Number ILM03.0.
- U.S. Environmental Protection Agency, 1997, Use of Monitoring Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites. Office of Solid Waste and Emergency Response Directive 9200.4-17.
- van der Meer, J.R., Roelofsen, W., Schraa, G., and Zehnder, A.J.B., 1987, Degradation of low concentrations of dichlorobenzenes and 1,2,4-trichlorobenzene by *Pseudomonas* sp. strain P51 in nonsterile soil columns: *FEMS Microbiol. Lett.*, 45:333-341.
- van Genuchten, M. Th. and Alves, W.J., 1982, *Analytical Solutions of the One-Dimensional Convective-Dispersive Solute Transport Equation*: U.S. Department of Agriculture, Technical Bulletin Number 1661, 151 p.
- Vanelli, T., Logan, M., Arciero, D.M., and Hooper, A.B., 1990, Degradation of halogenated aliphatic compounds by the ammonia-oxidizing bacterium *Nitrosomonas europaea*: *Appl. Environ. Microbiol.*, 56(4):1169-1171.
- Vogel, T.M., Criddle, C.S., and McCarty, P.L., 1987, Transformations of halogenated aliphatic compounds: *Environ. Sci. Technol.*, 21(8):722-736.
- Vogel, T. M., and Grbić-Galić, D., 1986, Incorporation of oxygen from water into toluene and benzene during anaerobic fermentative transformation: *Appl. Environ. Microbiol.*, 52:200-202.
- Vogel, T.M., and McCarty, P.L., 1987, Abiotic and biotic transformations of 1,1,1-trichloroethane under methanogenic conditions: *Environ. Sci. Technol.*, 21(12):1208-1213.
- Vogel, T.M., and McCarty, P.L., 1985, Biotransformation of tetrachloroethylene to trichloroethylene, dichloroethylene, vinyl chloride, and carbon dioxide under methanogenic conditions: *Appl. Environ. Microbiol.*, 49(5):1080-1083.
- Vogel, T.M., and Reinhard, M., 1986, Reaction products and rates of disappearance of simple bromoalkanes, 1,2-dibromopropane and 1,2-dibromoethane in water: *Environ. Sci. Technol.*, 20(10):992-997.
- Vogel, T.M., 1994, Natural bioremediation of chlorinated solvents, *In Handbook of Bioremediation*: (Norris, R.D., Hinchee, R.E., Brown, R., McCarty, P.L, Semprini, L., Wilson, J.T., Campbell, D.H., Reinhard, M., Bouwer, E.J., Borden, R.C., Vogel, T.M., Thomas, J.M., and Ward, C.H., Eds.), Lewis Publishers, Boca Raton, FL, p. 201-225.

- von Gunten, U., and Zobrist, J., 1993, Biogeochemical changes in groundwater-infiltration systems - Column Studies: *Geochimica et Cosmochimica Acta*, 57:3895-3906.
- Vroblesky, D.A., and Chapelle, F.H., 1994, Temporal and spatial changes of terminal electron-accepting processes in a petroleum hydrocarbon-contaminated aquifer and the significance for contaminant biodegradation: *Water Resour. Res.*, 30(5):1561-1570.
- Wackett, L.P., Brusseau, G.A., Householder, S.R., and Hanson, R.S., 1989, Survey of microbial oxygenases: Trichloroethylene degradation by propane-oxidizing bacteria: *Appl. Environ. Microbiol.*, 55(11):2960-2964.
- Wackett, L.P. and Gibson, D.T., 1988, Degradation of trichloroethylene by toluene dioxygenase in whole-cell studies with *Pseudomonas putida* F1: *Appl. Environ. Microbiol.*, 54(7):1703-1708.
- Wackett, L.P., 1995, Bacterial co-metabolism of halogenated organic compounds, *In Microbial Transformation and Degradation of Toxic Organic Chemicals*: (Young, L.Y., and Cerniglia, C.E., Eds.), Wiley-Liss, New York, 654 p.
- Walton, W.C., 1988, *Practical Aspects of Groundwater Modeling*: National Water Well Association, Worthington, OH, 587 p.
- Walton, W.C., 1991, *Principles of Groundwater Engineering*: Lewis Publishers, Chelsea, MI, 546 p.
- Wang, T.C., and Tan, C.K., 1990, Reduction of halogenated hydrocarbons with magnesium hydrolysis process: *Bull. Environ. Contam. Toxicol.*, 45:149-156.
- Weaver, J.W., Wilson, J.T., and Campbell, D.H., 1995, *Natural Attenuation of Trichloroethene at the St. Joseph, Michigan Superfund Site*, EPA Project Summary: EPA/600/SV-95/001, U.S. EPA, Washington, D.C.
- Weaver, J.W., Wilson, J.T., and Campbell, D.H., 1996, Case study of natural attenuation of trichloroethene at St. Joseph, Michigan, *In Proceedings of the Symposium on Natural Attenuation of Chlorinated Organics in Ground Water, Dallas, TX, September 11-13, 1996*: EPA/540/R-96/509.
- Weaver, J.W., Wilson, J.T., and Campbell, D.H., 1996, Extraction of degradation rate constants from the St. Joseph, Michigan, trichloroethene site, *In Proceedings of the Symposium on Natural Attenuation of Chlorinated Organics in Ground Water, Dallas, TX, September 11-13, 1996*: EPA/540/R-96/509.
- Westerick, J.J., Mello, J.W., and Thomas, R.F., 1984, The groundwater supply survey: *J. Am. Water Works Asso.*, 76:52-59.
- Wexler, E.J., 1992, Analytical solutions for one-, two-, and three-dimensional solute transport in ground-water systems with uniform flow: United States Geological Survey, Techniques of Water-Resources Investigations of the United States Geological Survey, Book 3, Chapter B7, 190 p.
- Wiedemeier, T.H., Benson, L.A., Wilson, J.T., Campbell, D.H., Hansen, J.E., and Miknis, R., 1996a, Patterns of natural attenuation of chlorinated aliphatic hydrocarbons at Plattsburgh Air Force Base, New York: Platform Abstract of the Conference on Intrinsic Remediation of Chlorinated Solvents, Salt Lake City, UT, April 2, 1996.
- Wiedemeier, T.H., Blicker, B., and Guest, P.R., 1994b, Risk-based approach to bioremediation of fuel hydrocarbons at a major airport: Federal Environmental Restoration III & Waste Minimization Conference & Exhibition.

- Wiedemeier, T.H., Guest, P.R., Henry, R.L., and Keith, C.B., 1993, The use of Bioplume to support regulatory negotiations at a fuel spill site near Denver, Colorado, *In Proceedings of the Petroleum Hydrocarbons and Organic Chemicals in Ground Water: Prevention, Detection, and Restoration Conference*: NWWA/API, p. 445 -459.
- Wiedemeier, T.H., Miller, R.N., Wilson, J.T., and Kampbell, D.H., 1994a, Proposed Air Force guidelines for successfully supporting the natural attenuation (natural attenuation) option at fuel hydrocarbon contaminated sites: Presented at the 1994 NWWA/API Outdoor Action Conference.
- Wiedemeier, T.H., Swanson, M.A., Wilson, J.T., Kampbell, D.H., Miller, R.N., and Hansen, J.E., 1995b, Patterns of intrinsic bioremediation at two United States Air Force Bases, *In Intrinsic Bioremediation*: (Hinchee, R.E., Wilson, J.T. and Downey, D.C., Eds.), Battelle Press, Columbus, OH.
- Wiedemeier, T.H., Swanson, M.A., Wilson, J.T., Kampbell, D.H., Miller, R.N., and Hansen, J.E., 1996b, Approximation of biodegradation rate constants for monoaromatic hydrocarbons (BTEX) in ground water: *Ground Water Monit. Remed.*, 16(3):186-194.
- Wiedemeier, T.H., Wilson, J.T., and Miller, R.N., 1995c, Significance of Anaerobic Processes for the Intrinsic Bioremediation of Fuel Hydrocarbons: *In Proceedings of the Petroleum Hydrocarbons and Organic Chemicals in Ground Water: Prevention, Detection, and Restoration Conference*: NWWA/API.
- Wiedemeier, T.H., Wilson, J.T., and Kampbell, D.H., 1996c, Natural attenuation of chlorinated aliphatic hydrocarbons at Plattsburgh Air Force Base, New York, *In Proceedings of the Symposium on Natural Attenuation of Chlorinated Organics in Ground Water, Dallas, TX, September 11-13, 1996*: EPA/540/R-96/509.
- Wiedemeier, T.H., Wilson, J.T., Kampbell, D.H., Miller, R.N., and Hansen, J.E., 1995d, Technical protocol for implementing intrinsic remediation with long-term monitoring for natural attenuation of fuel contamination dissolved in groundwater: U.S. Air Force Center for Environmental Excellence, San Antonio, TX.
- Willey, L.M., Kharaka, Y.K., Presser, T.S., Rapp, J.B., and Barnes, Ivan, 1975, Short chain aliphatic acid anions in oil field waters and their contribution to the measured alkalinity: *Geochimica et Cosmochimica Acta*, 39:1707-1711.
- Wilson, B.H., Ehlke, T.A., Imbrigiotta, T.E., and Wilson, J.T., 1991, Reductive dechlorination of trichloroethylene in anoxic aquifer material from Picatinny Arsenal, New Jersey, *In Proceedings of the U.S. Geological Survey Toxic Substances Hydrology Program, Monterey, CA*: (Mallard, G.E., and Aronson, D.A., Eds.), Water Resources Investigation Report 91-4034, p. 704-707.
- Wilson, B.H., Wilson, J.T., Kampbell, D.H., Bledsoe, B.E., and Armstrong, J.M., 1990, Biotransformation of monoaromatic and chlorinated hydrocarbons at an aviation gasoline spill site: *Geomicrobiology J.*, 8:225-240.
- Wilson, B.H., Bledsoe, B., and Kampbell, D., 1987, Biological processes occurring at an aviation gasoline spill site, *In Chemical Quality of Water and the Hydrologic Cycle*: (Averett, R.C. and McKnight, D.M., Eds.), Lewis Publishers, Chelsea, MI, p. 125-137.
- Wilson, B. H., Smith, G.B., and Rees, J.F., 1986, Biotransformations of selected alkylbenzenes and halogenated aliphatic hydrocarbons in methanogenic aquifer material - A microcosm study: *Environ. Sci. Technol.*, 20:997-1002.

- Wilson, B.H., Wilson, J.T., and Luce, D., 1996, Design and interpretation of microcosm studies for chlorinated compounds, *In Proceedings of the Symposium on Natural Attenuation of Chlorinated Organics in Ground Water, Dallas, TX, September 11-13, 1996*: EPA/540/R-96/509.
- Wilson, B.H., 1988, Biotransformation of Chlorinated Hydrocarbons and Alkylbenzenes in Aquifer Material from the Picatinny Arsenal, New Jersey. Proceedings of the Technical Meeting, Phoenix, Arizona, September 26-30, 1988. U.S. GSWRIR 88-4220.389-394.
- Wilson, J.L., and Miller, P.J., 1978, Two-dimensional plume in uniform ground-water flow: American Society of Civil Engineers, J. Hydr. Div., 104(HY4):503-514.
- Wilson, J.T., Leach, L.E., Henson, M., and Jones, J.N., 1986, In Situ bioremediation as a groundwater remediation technique: Ground Water Monit. Rev., Fall 1986, p. 56-64.
- Wilson, J.T., Campbell, D.H., and Armstrong, J., 1993, Natural bioreclamation of alkylbenzenes (BTEX) from a gasoline spill in methanogenic groundwater: *In Proceedings of the Environmental Restoration Technology Transfer Symposium*, San Antonio, TX.
- Wilson, J.T., Campbell, D., Weaver, J., Wilson, B., Imbrigotti, T., and Ehlke, T., 1995, A review of intrinsic bioremediation of trichloroethylene in ground water at Picatinny arsenal, New Jersey, and St. Joseph, Michigan; Symposium on Bioremediation of Hazardous Wastes: Research, Development, and Field Evaluations: U.S. EPA, Rye Brook, NY August 1995: EPA/600/R-95/076.
- Wilson, J.T., Campbell, D.H., and Weaver, J.W., 1996, Environmental chemistry and kinetics of biotransformation of chlorinated organic compounds in ground water: *In Proceedings of the Symposium on Natural Attenuation of Chlorinated Organics in Ground Water, Dallas, TX, September 11-13, 1996*: EPA/540/R-96/509.
- Wilson, J.T., McNabb, J.F., Wilson, B.H., and Noonan, M.J., 1982, Biotransformation of selected organic pollutants in groundwater: Develop. Ind. Microbiol., 24:225-233.
- Wilson, J.T., McNabb, J.F., Balkwill, D.L., and Ghiorse, W.C., 1983, Enumeration and characteristics of bacteria indigenous to a shallow water-table aquifer: Ground Water, 21:134-142.
- Wilson, J.T., McNabb, J.F., Cochran, J.W., Wang, T.H., Tomson, M.B., and Bedient, P.B., 1985, Influence of microbial adaptation on the fate of organic pollutants in groundwater: Environ. Toxicol. Chem., 4:721-726.
- Wilson, J.T., Pfeffer, F.M., Weaver, J.W., Campbell, D.H., Wiedemeier, T.H., Hansen, J.E., and Miller, R.N., 1994, Intrinsic bioremediation of JP-4 jet fuel: United States Environmental Protection Agency, Symposium on Natural Attenuation of Ground Water, EPA/600/R-94/162, p. 60-67.
- Wilson, J.T., and Wilson, B.H., 1985, Biotransformation of trichloroethylene in soil: Appl. Environ. Microbiol., 49(1):242-243.
- Wilson, J.T., 1988, Degradation of halogenated hydrocarbons: Biotec., 2:75-77.
- Wood, P.R., Lang, R.F., and Payan, I.L., 1985, Anaerobic transformation, transport, and removal of volatile chlorinated organics in ground water, *In Ground Water Quality*: (Ward, C.H., Giger, W., and McCarty, P.L., Eds.), John Wiley & Sons, New York, p. 493-511.
- Wu, J., Roth, C.B., and Low, P.F., 1988, Biological reduction of structural iron in sodium-ntronite: Soil Sci. Soc. Am. J., 52:295-296.
- Xu, M., and Eckstein, Y., 1995, Use of weighted least-squares method in evaluation of the relationship between dispersivity and scale: Ground Water, 33(6):905-908.

- Young, L.Y., 1984, Anaerobic degradation of aromatic compounds, *In Microbial Degradation of Aromatic Compounds*: (Gibson, D.R., Ed.), Marcel-Dekker, New York.
- Young, S.C., 1995, Characterization of high-K pathways by borehole flowmeter and tracer tests: *Ground Water*, 33(2):311-318.
- Young, S.C. and Pearson, H.S., 1995, The electromagnetic borehole flowmeter: Description and application: *Groundwater Monit. Remed.*, Fall 1995, p.138-147.
- Zehnder, A.J.B., 1978, Ecology of methane formation, *In Water Pollution Microbiology*: (Mitchell, R., Ed.), Wiley, New York, p. 349-376.
- Zeyer, J., Kuhn, E.P., and Schwarzenbach, R.P., 1986, Rapid microbial mineralization of toluene and 1,3 dimethylbenzene in the absence of molecular oxygen: *Appl. Environ. Microbiol.*, 52:944-947.